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Nemzetközi tudományos konferencia
a Magyar Tudomány Ünnepe alkalmából
International Scientific Conference
on the Occasion of the Hungarian Science Festival

Sopron, 2025. november 6.
6 November 2025, Sopron

FEJLŐDÉSI PÁLYÁK ÉS ÚJ TÖRÉSVONALAK A FENNTARTHATÓSÁGI ÁTMENET IDŐSZAKÁBAN

DEVELOPMENT TRAJECTORIES AND NEW DIVIDES IN TIMES OF SUSTAINABILITY TRANSITIONS

Szerkesztők / Editors:
RESPERGER Richárd, SZÉLES Zsuzsanna, TÓTH Balázs István

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Toward Zero Waste: Applying the 9R Framework in Sustainable Event Management

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Abstract
Given the substantial environmental burden associated with the event management industry, this study aims to identify and synthesize effective waste reduction strategies through the lens of the 9R framework: Refuse, Reduce, Reuse, Repurpose, Recycle, Recover, Repair, Remanufacture, and Refurbish; with the overarching objective of achieving Zero Waste in event organization. While the conceptual definitions of these strategies may appear straightforward, their practical implications within the event context warrant detailed examination. This research explores the environmental impacts of event-related activities, particularly those linked to catering, procurement, and transportation, and presents evidence-based interventions to mitigate these effects. By integrating insights from academic literature, industry case studies, and operational guidelines, the study emphasizes the relevance of circular economy principles and advocates for a paradigm shift in event planning practices. The findings support the adoption of stakeholder-inclusive approaches, the prioritization of local sourcing, and the utilization of digital technologies as critical enablers of sustainable event management, thereby contributing to the reduction of carbon emissions and the conservation of natural resources.

Keywords: sustainability, green events, circular economics, waste management, 9R
JEL Codes: Q01, Q53, Q56, O13, P41

1. Introduction

Due to population growth shopping habits have changed. More people need more food, suppies, houses and goods. In the last century, as the economy grew, the solid waste generation increased enormously. The world is expected to generate 3.4 billion tons of waste by 2050 (Balwan et al., 2022). Although in the last forty years the organizations started to educate the people, the third of all waste is still not managed in an environmentally safe manner. Richer countries have better waste management program, but most of their waste arrives to landfill sites. This shows the linear economy model, where no resource is recycled or given back to Mother Nature. Our goal should be to preserve the environment and organize our lives in a way that will not compromise the ability of future generations to meet their own needs.

Since the event management industry is responsible for generating a significant amount of waste, the aim of this study is to collect ideas and solutions using the 9R framework to achieve Zero Waste of the events. It will summarize the best good practices found in various literature and scientific journals and provide useful knowledge in sustainable event management.

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This study partially agrees with the definition of waste from Balwans (2022): “any product or substance which is no longer suited for its intended use”. The explanation would suggest the linear economy model, on the other hand the unusable products could get longer lifespan which would support the circular economy.

Waste can be classified into distinct categories based on its origin, composition, and potential environmental impact. Municipal Solid Waste (MSW) primarily originates from residential sources and encompasses everyday items discarded by households. In parallel, Commercial Waste is generated by businesses and institutions, typically comprising organic residues (e.g., food scraps), paper, plastics, and textiles.

The construction and demolition sector contributes significantly to the overall waste stream, predominantly through materials such as asphalt, steel, and concrete. A separate category, Hazardous Waste, includes substances that pose substantial risks to human health and the environment. This group encompasses, among others, electronic waste (e-waste) and biomedical waste, both of which require specialized handling and disposal protocols.

From a physical state perspective, waste materials may be classified as solid, liquid, or gaseous, depending on their form and behavior under ambient conditions. For the purposes of recycling and automated waste sorting we categorize waste into six primary material types: glass, metal, paper, plastic, cardboard, and a residual category labeled other (Azis et al., 2020).

Its disposal can have a huge environmental impact, therefore sustainable event management promotes proper waste management.

2. Literature review

Every author of books and research papers related to event management agrees that the greatest challenges are the lack of knowledge, financial resources, and managerial support.
Engaging stakeholders facilitates collaboration and enhances the effectiveness of waste reduction strategies. For instance, involving suppliers in green procurement practices or educating participants on proper waste management can significantly reduce the environmental impact of events (Surbhi & Bose, 2025)

In the 1950s, the volume of solid waste began to increase dramatically, prompting the emergence of the 3R framework (Reduce, Reuse, and Recycle) as a foundational model for sustainable waste management. This triadic approach aimed to mitigate environmental impact by minimizing resource consumption, extending product lifecycles, and promoting material recovery.

In her book Zero Waste Home (2013), Bea Johnson demonstrated the practical application of these principles within a domestic setting. She introduced an expanded model known as the 5R hierarchy (Refuse, Reduce, Reuse, Recycle, and Rot) emphasizing a systemic approach to minimizing household waste through behavioral change, consumption reduction, and organic waste composting (Johnson, 2013).

If a business genuinely aims to operate sustainably within the circular economy, it should seriously consider adopting the 5R concept: Refuse, Reduce, Reuse, Recycle, and Rot. The MaReSz (Federation of Hungarian Event Organizers and Suppliers) in collaboration with HighVibes agency has developed a valuable presentation in 2025 that offers practical recommendations for implementing green events from this perspective. They added the next R (Repurpose), which is a very effective way of expending the lifespan of the products (Rendezvényszervezők és -szolgáltatók Szövetsége, 2025).

In households, another important R is Repair, which is increasingly disappearing from our daily routines and offers limited applicability in event management. There is also an useful R: Rot, which symbolizes the decomposition process. However, in this context, I interpret it as being integrated within the broader recycling process.

The biggest issue is the recycling of plastic products. According to the 2022 report of the Organisation for Economic Co-operation and Development (OECD, 2022): “*Globally, ... only*

9% of plastic waste was ultimately recycled, while 19% was incinerated and almost 50% went to sanitary landfills. The remaining 22% was disposed in uncontrolled dumpsites, burned in open pits or leaked into the environment." Although the number of recycling facilities may be increasing, their expansion fails to keep pace with the exponential growth in plastic production.

At several sustainability-focused events, 0,5-liter polyethylene (PET) bottled water is provided, occasionally at no cost to participants. Based on EU directives, Hungary launched its mandatory deposit return system (DRS) for beverage packaging, including PET bottles, on 1 January 2024, in order to achieve the 90% collection target set for 2029. Event organizers have justified this practice by referencing the MOHU (MOL Waste Management Plc) recycling initiative, which ensures that post-consumer PET bottles are directed to appropriate recycling facilities for material recovery and potential reuse. While this rationale aligns with circular economic principles, it warrants critical examination.

Despite the availability of recycling infrastructure, the continued use of single-use plastic products, particularly PET bottles, remains problematic. Empirical evidence indicates that even after multiple recycling cycles, plastic polymers degrade in quality and ultimately become non-recyclable, leading to their disposal in landfills or incineration facilities. This outcome contradicts the long-term objectives of sustainable resource management.

Therefore, from a lifecycle perspective, the provision of PET bottled water should be minimized or eliminated in favor of reusable alternatives. Glassware, which offers superior durability and recyclability without significant degradation, represents a more environmentally responsible option for beverage distribution at sustainable events.

According to the Green Office Manual, approximately 20% of carbon emissions associated with food arise not only from agricultural activities, such as fertilization, irrigation, plastic mulching, and greenhouse heating, but also from the transportation of products over long distances (European Green Office, 2010).

2.1. Refuse / Rethink

Right at the very start of the event management process, thoughtful planning is necessary. Prioritization is essential when deciding on the purchasing amount and quality.

From a sustainability perspective, purchasing bamboo-based gifts is inadvisable, as these items are often transported thousands of kilometers, contributing significantly to greenhouse gas (GHG) emissions. The same principle applies to non-seasonal or non-local food items that are not naturally available in Hungary.

Since food consumption is an almost inevitable component of event planning, it is crucial to consider environmental implications in catering decisions. Transportation, especially air travel, has a disproportionately high carbon footprint. Not only do participants arrive via air transport, but many products used at events, such as imported fruits like kiwi and banana, or bamboo straws and floral decorations, also travel long distances, exacerbating GHG emissions.

Collaborating with local suppliers can substantially reduce the ecological footprint of an event (Ramely et al., 2022). For example, instead of accepting fruit salads containing mangoes and bananas, organizers could opt for seasonal alternatives like Hungarian peach compote during winter months.

While meat production is widely recognized as one of the most environmentally damaging activities due to its high GHG emissions, many advocate for vegetarian diets as a mitigation strategy. However, life cycle assessments (LCA) reveal that in some cases, locally sourced chicken may have a lower carbon footprint than imported plant-based products such as smoked tofu. It also has a socially sustainable impact on the local communities, as it creates economic security for them (Mair & Smith, 2021).

Beverages ordered in large quantities, when not delivered in small plastic bottles, can significantly reduce the amount of waste generated. Serving juices in pitchers is both visually appealing and environmentally friendly. It is also practical, as consumption can be monitored

easily. It is the responsibility of the event organizer to ensure that this practice is genuinely implemented, and that drinks are not simply poured from one-liter cartons, which would generate unnecessary waste (Kim et al., 2023).

Baldwin's study 2011 highlighted that restaurant procurement accounts for nearly 95% of environmental impacts. Conscientious companies assess the energy consumption of catering facilities both during idle periods and throughout the event (including preparation time) (Baldwin et al., 2011). Therefore, it is worth reconsidering the use of venues that cannot provide accurate environmental data.

Carbon footprint calculations also extend to food purchasing decisions, such as the quantity of meat served and the origin of the ingredients (Jones, 2025).

The EEA report addressed the presence of microplastics smaller than 5 mm, which pose significant risks to the health of living organisms. Primary microplastics are typically released into the air, soil, and water during industrial manufacturing processes. Secondary microplastics result from the breakdown of larger plastic items, most commonly during waste management activities (e.g., PET bottles), the washing of synthetic textiles, tire abrasion, and the use of certain cosmetic products (European Environment Agency & European Commission Joint Research Centre, 2025).

In 2015, the European Union voted to ban plastic bags. As a result, no event should use them, and gifts intended for promotional purposes are now often distributed in paper or, preferably, canvas bags.

Printing not only consumes paper, thus contributing to deforestation, but also involves materials such as ink, lamination, and other plastic-based components that cause substantial environmental harm. It is advisable to investigate whether recycled materials are available for these purposes and whether refillable ink cartridges are being used (Jones, 2025).

The 21st century offers vast opportunities through the advancement of digital technologies. Sending printed invitations to guests is increasingly unnecessary, as email is now a fully accepted form of communication. It is no longer surprising for attendees to register via a website to participate in a conference. Paper is rapidly disappearing from events.

Printed flyers have become rare due to their high costs, graphic design, paper, printing, and transportation, and their tendency to quickly become waste. Genuine interest is typically driven by online information, resulting in fewer paper materials on office desks. If printing is unavoidable (e.g., for directional signage), it is advisable to use recycled paper certified by the FSC (Rendezvényszervezők és -szolgáltatók Szövetsége, 2025).

Few companies consider it, but printed napkins could also be eliminated. For a more elegant alternative, embossed patterns can be applied without ink (Jones, 2025). Event-related information is now displayed on LED screens, company presentations run on monitors, and conference programs are digitally accessible.

Business cards are becoming obsolete, as contact details are exchanged directly or reminders are sent via email during networking.

2.2. Reduce

If the procurement of environmentally intensive goods cannot be avoided, it is essential to minimize their quantity. For example, gift bags containing notebooks and pens should only be ordered in quantities matching the number of registered participants. Many attendees may leave their items behind, resulting in unnecessary waste accumulation.

Travel is a major contributor to environmental pollution, particularly air travel. Therefore, inviting international guests should be reserved for cases where their presence is absolutely necessary. When the venue allows, many companies actively encourage employees to use bicycles or electric scooters for commuting and reward such behavior. These initiatives play a significant role in promoting environmental awareness and reducing the carbon footprint of events.

Organizing smaller events under the shaded trees of a park can be highly beneficial, as fresh air and natural light offer an energy-efficient and health-promoting alternative. Provided that waste collection and disposal are properly managed and no harm is done to the vegetation, such events can be implemented more cost-effectively and with greater environmental awareness.

Although online presentations are not entirely carbon-neutral, the emissions from servers and electronic devices are significantly lower than the carbon footprint associated with attendee travel, accommodation, and catering. Avoiding the need to heat or cool large venues can lead to substantial reductions in energy bills. It is worth considering the size of the event space, as oversized rooms can become energy drains (Jones, 2025).

Thoughtful purchasing decisions and targeted selection can yield excellent results. A company can also reduce its environmental impact by choosing more efficient procurement routes, for example, sourcing gifts from local businesses that require shorter transport distances and may be produced with lower water usage.

A precise and data-driven registration process enables accurate forecasting of participant numbers, thereby optimizing resource allocation and minimizing excess waste generation. High-cost catering services can adopt environmentally responsible practices by reducing energy consumption, limiting food waste, and streamlining material usage throughout the event lifecycle (Baldwin et al., 2011) .

It is to be considered to share information to the participants through social media channels which reduce the numbers of flyers or brochures (Ramely et al., 2022)

If printed materials, ink consumption, unnecessary gifts, surplus pens destined for disposal, and energy and water usage can all be reduced, the cumulative savings in the budget can be redirected toward additional sustainability measures, such as waste sorting.

Reducing both the quantity of food and the distance it travels can contribute to lower carbon emissions associated with logistics. Partnering with local vendors shortens the supply chain, thereby decreasing transportation-related environmental impacts. Although this strategy may not directly reduce the volume of waste, it represents a meaningful approach to promoting environmental sustainability.

2.3. Reuse

Polypropylene cups are extremely inexpensive and easy to handle, which tempts many companies to use them. However, considering that they take several centuries to decompose, their long-term environmental burden is substantial. Investing in more elegant, albeit slightly more expensive, reusable utensils is a more sustainable choice.

Most companies focus primarily on replacing disposable plastic cutlery, as it is the most visible environmental concern. Currently, no single-use item is more suitable than reusable porcelain and glass plates, cups, and metal utensils. While the cleaning process does involve water and chemical consumption, the overall environmental impact remains significantly lower over time.

Replacing bottled water, especially PET bottles, with filtered water served in reusable glass containers can lead to considerable cost savings and a substantial reduction in carbon emissions. Even better results can be achieved if attendees are encouraged to refill their own bottles (Jones, 2025).

During meals, porcelain and glass plates and cups offer excellent alternatives to paper and plastic products. Although reusable plastic cups do not decompose quickly, they are still a better option than cheap disposable plastic items due to their reusability. These cups can be used multiple times, even at home, just like refillable bottles and other reusable plastic containers.

It is not advisable to print dates on expensive banners or lanyards, as this allows them to be reused at events over several years. This is both cost-effective and environmentally conscious. Plastic signs don't need to be discarded immediately either; instead, printing new stickers and placing them over the old ones is a significantly more economical and eco-friendly solution.

A large portion of marketing budget is spent on exhibition booths. Currently, there are few visually appealing alternatives to the many plastic components used. In the early 2000s, paper-based chairs and furniture were introduced as eco-friendly options, but they proved difficult to print on and lacked aesthetic appeal, which ultimately prevented them from gaining popularity.

The repeated use of expensive polypropylene-based stand elements is currently considered the most environmentally friendly option. Due to high storage costs, companies often prefer to rent decorative elements onto which they can print their own messages or logos. Although removing printed materials still generates waste, this approach results in less durable plastic ending up in nature.

When organizing a successful event, it's important not to overlook seemingly minor services that have a major impact. For example, sitting all day in a heavy coat without a cloakroom is extremely uncomfortable. Even at this stage, environmental considerations matter, participants should be given reusable plastic or preferably metal tags instead of paper ones, helping to reduce overall waste.

2.4. Repurpose

This concept is often referred to as "upcycling". When a product reaches the end of its original use, it's worth finding a new function for it to extend its lifecycle and reduce its carbon footprint. For example, the material used in event banners is so rigid and durable (yet slow to decompose) that it can be repurposed into tote bags during team-building activities. This makes for an excellent CSR initiative, especially when supporting a foundation or charitable organization and an outstanding opportunity for participant education.

If non-refundable plastic bottles remain after an event, they can be transformed on-site into bird feeders or vases through creative workshops. These fun and engaging programs can be enriched with educational content to raise environmental awareness.

Among eco-friendly invitations, perhaps the most charming is "seed paper", which can be planted after the event to grow wildflowers or herbs. These invitations don't become waste, they re-enter the cycle and come to life in a pot or garden (Rendezvényszervezők és -szolgáltatók Szövetsége, 2025).

Some events offer special meals for VIP guests. In these cases, it's not only important to list allergens but also to highlight ingredients sourced from sustainable livestock farming. If these premium meals are not fully consumed, they can be offered to staff members during the post-event debriefing. This gesture not only reduces food waste but also boosts morale for the following day's program.

The Hungarian Food Bank Association accepts surplus cooked meals in hygienic packaging and distributes them to those in need. Although a well-organized event typically generates minimal leftover portions, this still presents an excellent CSR opportunity for catering providers to support individuals who may not have access to quality food that day.

2.5. Repair and Refurbish

This is the least used tool in the event manager's kit. In case the booth items are rented, the vendor repairs the items or refurbishes them to make a use of it again.

This practice significantly reduces the demand for virgin raw materials and mitigates waste generation, contributing to resource efficiency and lower environmental impact.

By maintaining or enhancing the utility of existing components, this method aligns with circular economic principles, promoting material retention within the production-consumption loop. It also exemplifies a shift from linear to regenerative design strategies, where the emphasis is placed on durability, adaptability, and long-term value creation.

Refurbishing is a very rarely used zero waste approach. Refurbishing vintage furniture for example for VIP lounges is a scientifically sound waste reduction strategy that contributes to sustainable event management. It exemplifies the principles of circular design, reduces environmental burden, and adds cultural value to temporary spaces. Future research should quantify lifecycle emissions and explore scalable models for broader adoption across the event industry.

2.6. Recycle (Returning Materials to the Circular Economy)

Our finite natural resources pose risks to both the economy and everyday life. In a circular economy, biological elements are extracted from nature, used, and then reintegrated into the ecosystem as biodegradable waste. According to a 2019 study by the Business Council for Sustainable Development in Hungary (BCSDH), although less than half of respondents were truly committed to this issue, 44% reported purchasing recycled or recyclable materials, and 41% actively ensured the reversibility of their waste.

In 2024, Hungary ranked second to last on the eco-innovation index, largely due to government cutbacks in environmental and energy-related research and development (European Commission, 2024). The BCSDH report emphasizes the importance of knowledge sharing, education, and the dissemination of best practices (BCSDH, 2024).

At the 2006 Sziget Festival in Budapest, 2,200 cubic meters of waste were generated, equivalent to the amount of trash produced by a ten-story building over 9–10 years (Dávid, 2009). This volume increased proportionally with the number of attendees.

The most effective way for companies to reduce waste is to avoid overproduction. For example, by using registration data to accurately estimate the number of participants, organizers can better manage food portions and the associated waste. Another key strategy is to use materials that are easily compostable. However, even utensils labeled as 100% biodegradable often require industrial conditions to break down properly.

It’s worth considering what the most sustainable solution might be, one that balances practicality, environmental impact, and long-term viability.

Not everyone embraces paper cups without reservations. The market continues to rely on disposable plastic cups, largely because the average price of a 200 ml polypropylene cup is around 10 Hungarian forint, while paper-based alternatives cost approximately 23 Hungarian forint. Upon closer inspection, even so-called 100% eco-friendly paper cups contain a thin plastic lining to prevent leakage, otherwise, they would soak through quickly, much like today’s paper straws.

Cups and plates made from PLA (polylactic acid), a plant-based bioplastic derived from corn starch, are marketed as biodegradable. However, composting these materials requires industrial conditions and takes about 12 weeks (Rendezvényszervezők és -szolgáltatók Szövetsége, 2025). The carbon footprint of this process remains a subject of debate.

Aluminum, while highly recyclable, is energy-intensive to produce; therefore, extending its lifecycle through remanufacturing offers substantial ecological benefits.

Recycling has been known for decades, yet confusion persists, especially regarding which bin beverage cartons belong in. Materials often get mixed in general waste bins, requiring external assistance for sorting and transport. It’s essential to clarify waste management options during site inspections and communicate the importance of proper separation.

Providing separate bins is not enough if clear instructions are missing. Whether through lists or visual guides, it must be indicated where each type of waste should go. This can even be turned into a simple educational game. In Hungary, the most common bins are for plastic,

paper, and general waste, but bins labeled for beverage cartons, metal, and municipal waste are also increasingly available.

It is the event organizer's responsibility to ensure that selectively collected waste reaches the appropriate section of the landfill or recycling facility.

The Zöldövezet Association aims to support the environmental relief of events. Their services include waste sorting, recycling, education, and other useful tasks. Their website notes that even small steps can help reduce costs, for example, by compressing discarded beverage cartons, where companies pay for the actual material transported rather than the air inside. They also support the Repohár deposit system and contribute ideas for its implementation. RePlacc promotes innovative ways to reuse waste materials (Zöldövezet Társulás, 2025).

2.7. Recover, Remanufacture, Rot

Most restaurants are prepared to compost the food crap. If biological waste generated from food is not composted or sent to landfill, it is incinerated to produce thermal energy, which is then used to heat residential buildings or public institutions. This is a form of energy recovery that can reduce reliance on fossil fuels, although incineration remains a controversial practice from an environmental perspective.

In the context of sustainable event management, remanufacturing refers to the process of collecting previously used structural components, such as aluminum frames and supports from exhibition stands, refurbishing them, and repurposing them for future use. Unlike conventional recycling, which involves the breakdown of materials into raw form, remanufacturing preserves the functional integrity of the original components through cleaning, repair, and reassembly.

3. Summary

Effective management of waste during event organization is a critical component of sustainable development, particularly considering the increasing environmental pressures and the growing scale of the event industry. This study has demonstrated that the integration of the 9R framework: Refuse, Reduce, Reuse, Repurpose, Repair, Refurbish, Recycle, Recover, and Remanufacture, offers a comprehensive and adaptable strategy for minimizing environmental impact.

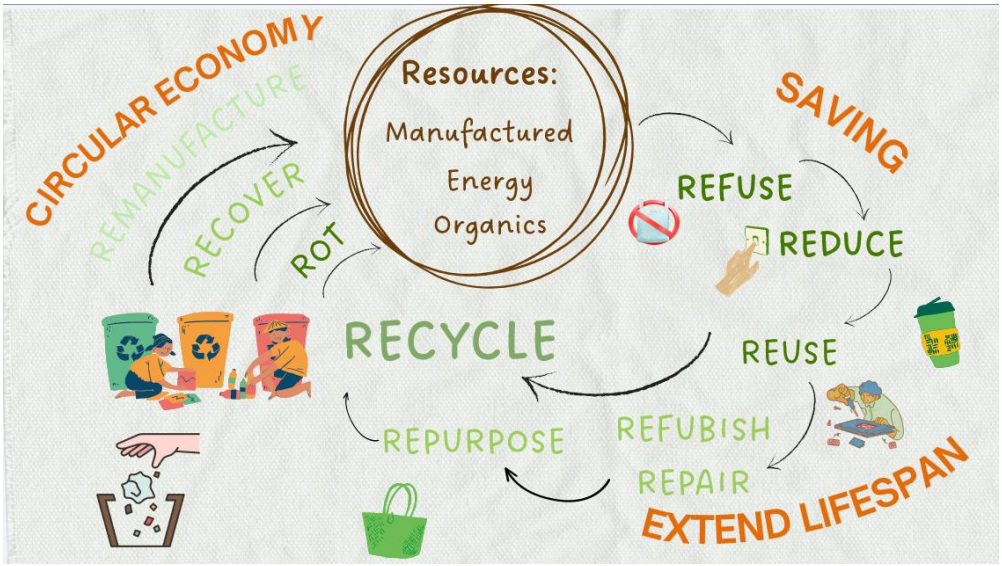

Figure 1: Circular economy through 9R framework
Source: Own illustration

As illustrated in *Figure 1*, Circular Economy through the 9R Framework, the author identifies three primary resource categories: organic materials (e.g., food), energy (electricity and water), and manufactured products. The most effective strategy for resource conservation is the principle of Refuse, applied at the earliest stage of event planning, specifically by avoiding the procurement of environmentally detrimental products.

In cases where such products are deemed indispensable, strategic procurement practices should be employed. By accurately estimating participant numbers, organizers can optimize purchasing volumes, thereby minimizing surplus. Vendors should be required to implement energy-efficient solutions to reduce the overall environmental footprint.

Subsequent stages of the product lifecycle may be extended through Reuse and Repair, promoting longevity and reducing waste. Additionally, creative repurposing activities can transform used goods into new functional items, aligning with the Repurpose principle of the 9R framework.

The overarching objective of the circular economy is to ensure that resources are retained within the system through effective Recycling. Proper utilization of selective waste collection infrastructure enables the recovery of materials such as aluminum, paper, and organic waste, thereby facilitating closed-loop resource flows. A remanufactured product can start a new life as a bottle cap or an automative component.

Through the analysis of best practices, stakeholder engagement, and empirical insights, it becomes evident that sustainable event management requires a systemic shift from linear to circular models. Emphasis on local procurement, digitalization, and the extended utility of materials contributes significantly to reducing carbon emissions and resource depletion. Furthermore, the study highlights the importance of behavioral change, institutional commitment, and knowledge dissemination in achieving zero waste objectives. While challenges persist, particularly in terms of infrastructure, awareness, and economic feasibility, the findings underscore that even incremental improvements can yield substantial ecological and economic benefits. Future research should focus on quantifying the long-term impacts of these interventions and developing scalable models that can be adapted across diverse event contexts.

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